

Vascular Plant Flora of Pipe Spring National Monument: 2008 Update

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Front Cover: Prince's plume (*Stanleya pinnata*), Small-leaf globemallow (*Sphaeralcea parvifolia*), Desert trumpet (*Eriogonum inflatum*) and other spring wildflowers growing on Moenkopi soils along south-facing slopes of the Ridge Trail, west of West Cabin in Pipe Spring National Monument. Photo by W. Fertig, 10 May 2008.

Introduction

Over the past decade, the National Park Service has funded several research projects to better document the vascular plant flora of Pipe Spring National Monument (PISP) in northern Arizona (Alexander 1998a, 1998b, 2004, Fertig and Alexander 2008). These studies have included new field surveys, review of pertinent literature, and re-examination of plant specimens from the PISP herbarium and other selected regional herbaria to correct misidentifications and update nomenclature. At the conclusion of the 2007 field season, the flora of Pipe Spring stood at 277 vascular plant taxa, of which 215 were represented by specimen vouchers and 62 were reliably reported (without vouchers) from the scientific literature. Another 41 species were listed as potentially occurring in the monument based on records from the vicinity (Fertig and Alexander 2008).

In our summary report, Jason Alexander and I suggested that additional surveys were still needed at Pipe Spring (Fertig and Alexander 2008). In particular, a large number of weeds, spring annuals, cultivated plants, wetland species, and late summer/fall-flowering taxa seemed to be under-represented in the monument flora. Nearly a third of the plant species from Pipe Spring (112 taxa) remained unvouchered or had not been relocated since 1970 and were considered historical.

Based on these recommendations, PISP chief of natural resources Andrea Bornemeier requested a follow-up survey in 2008 to identify new plant species for the monument and to collect vouchers for taxa that were previously reported or historical. The following report summarizes the discoveries made in the 2008 field season and serves as an addendum to the 2008 annotated checklist (Fertig and Alexander 2008).

Methods

In order to maximize the number of new spring annuals and late summer blooming species to be found, I made two collecting trips to Pipe Spring National Monument on 10 May and 30 August 2008. I surveyed all of the major habitats of the monument but focused special attention on weedy sites, the cultivated garden area, and wetland habitats near Winsor Castle and the West Cabin. During these explorations, I consulted the 2008 monument checklist to determine whether each species I encountered had been previously documented or vouchered, and whether information on population size or park status was in need of revision. I recorded habitat, abundance, and location data (using a handheld Garmin GPS unit) for all native and naturalized species that were not previously known from Pipe Spring or were not represented by vouchers in the PISP herbarium. Collections were labeled, mounted, and deposited in the PISP herbarium. Vouchers were not collected for cultivated species from the monument's pioneer and Indian garden or from landscaping outside of the visitor center.

Results and Discussion

Surveys in 2008 resulted in the discovery of 36 new vascular plant species for Pipe Spring National Monument (Figure 1, Tables 1, 2), increasing the total number of species confirmed or reliably reported for the monument from 277 to 313 (an increase of 11.5%). Three additional plant families (Pedaliaceae, Vitaceae, and Zannichelliaceae) were discovered, bringing the total number of families in the monument flora to 59 (Table 1). At least 21 of the new species are known only from cultivation in the monument's pioneer and Indian garden. Another 12 species known previously from literature reports were verified as occurring at Pipe Spring with new specimen vouchers, photos, or observations (Table 3). Six of the new species had previously been listed as "potential" members of the flora based on the proximity of known populations to the monument (Table 3) (Appendix B of Fertig and Alexander 2008). Five of the 50 species listed as historical for Pipe Spring were rediscovered in 2008 (Fertig and Alexander 2008).

Stonewort (*Chara* sp. in the family Characeae), a type of macroscopic algae, was collected in the pond adjacent to Winsor Castle in May 2008. This species superficially resembles pondweed (*Zannichellia palustris* or *Potamogeton* sp.), but is not a true vascular plant. It could not be identified to species because of an absence of reproductive organs, but a specimen has been deposited in the PISP herbarium.

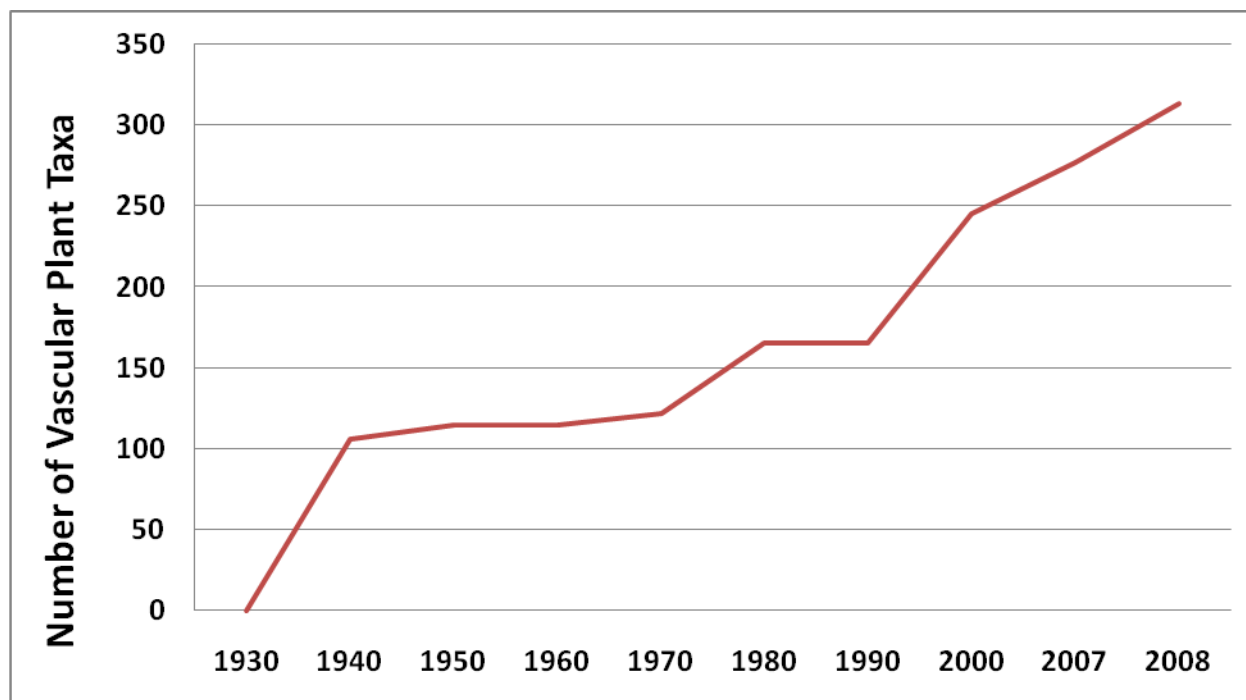


Figure 1. Increase in the Number of Vascular Plant Taxa from Pipe Spring National Monument from 1930-2008 (revised from Figure 1.3.4 in Fertig and Alexander 2008 based on additional collections from the 2008 field season).

Table 1. Statistical Summary of the Flora of Pipe Spring National Monument. This table updates Table 3.1 from Fertig and Alexander (2008) and reflects new species discovered or relocated in 2008. The number of taxa and families is based on taxonomic concepts of Welsh et al. (2008).

Flora of Pipe Spring National Monument	Present or Historical in Park	Reported for Park	Total
Taxonomic Diversity			
Total # of Taxa (including varieties and sub-species)	263	50	313
# of Full Species (excluding varieties and sub-species)	250	46	296
# of Families	57	2	59
Life Form Diversity			
# of Tree Taxa	8	2	10
# of Shrub Taxa	36	5	41
# of Perennial Forb Taxa	82	24	106
# of Annual Forb Taxa	96	6	102
# of Perennial Graminoid Taxa	28	11	39
# of Annual Graminoid Taxa	13	2	15
# of Fern Taxa	0	0	0
Biogeographic Diversity			
# of Introduced Taxa	68	16	84
# of Locally Endemic Taxa	4	0	4
# of Regionally Endemic Taxa	15	7	22
# of Disjunct Taxa	0	0	0
# of Peripheral Taxa	4	1	5
# of Sparse Taxa	1	0	1
# of Widespread Taxa	171	26	197
Total # Native Taxa	195	34	229

Perennial forbs remained the most species-rich life form in the flora of Pipe Spring. Eight new taxa of perennial forbs were discovered in 2008, raising the total number of taxa in this category to 106 (Table 1). Annual forbs exhibited the greatest increase in species richness, with 21 new species being added to the flora in 2008. In addition, six new graminoid species were discovered this year (3 each among annual and perennial species) and one new shrub (an unidentified species of grape being grown in cultivation).

Twenty-six of the new species found in 2008 are introduced species that are not native to Arizona, increasing the total number of exotic species at Pipe Spring to 84 (an increase of 31%) (Tables 1, 2). Of these new species, 21 are cultivated in the monument's pioneer and native culture garden and are otherwise not naturalized. None of the newly documented introduced species are considered Noxious by the state of Arizona. Of the 10 new native species discovered in 2008, nine are widespread across Arizona. Baker's cryptanth (*Cryptantha bakeri*) was the only new Colorado Plateau regional endemic to be found. It is not considered a species of conservation concern in Arizona.

Because the only complete flora of Arizona is nearly 50 years old and badly out of date, Fertig and Alexander (2008) adopted the flora of Utah as the taxonomic standard for Pipe Spring National Monument. In 2008, the fourth edition of the Utah Flora was published (Welsh et al. 2008). Table 3 includes updated names for five species, as well as revisions in the status of 20 other taxa cited in the 2008 monument checklist.

As illustrated in Figure 1, the number of plant species recorded for Pipe Spring National Monument over the past decade has continued to grow and presently shows no signs of leveling off. Since 2000, the documented flora of the monument has increased by nearly 20% and at least 40 species known from the immediate vicinity of PISP might still be discovered in the future (Fertig and Alexander 2008). The results of the 2008 survey suggest that additional discoveries are still likely to be made at Pipe Spring and that more field work (spread over the entire growing season) is justified.

Table 2. New Vascular Plant Taxa Confirmed for Pipe Spring National Monument Based on 2008 Survey

Family	Species Name	Synonyms/ Taxonomic Notes	Common Name	Life Form	Range	Park Status	Pop. Size	Source	Year Doc.	Comments
Amaranthaceae	<i>Amaranthus retroflexus</i>		Redroot pigweed	AnnF	Intro	Pres	Unc	Fertig 24316 (PISP)	2008	New to PISP, previously on potential list. Native to Central America
Boraginaceae	<i>Cryptantha bakeri</i>	<i>Oreocarya bakeri</i>	Baker's cryptanth	PerF	RegEn	Pres	Rare	Fertig 23829 (PISP)	2008	New to PISP
Boraginaceae	<i>Cryptantha recurvata</i>		Recurved cryptanth	AnnF	Wide	Pres	Rare	Fertig 23827 (PISP)	2008	New to PISP, previously on potential list.
Chenopodiaceae	<i>Atriplex rosea</i>		Tumbling orach	AnnF	Intro	Pres	Rare	Fertig 24328 (PISP)	2008	New to PISP. Native to Eurasia
Compositae (Asteraceae)	<i>Chaenactis stevioides</i>		Stevia dusty- maiden	AnnF	Wide	Pres	Rare	Fertig 23825 (PISP)	2008	New to PISP, previously on potential list.
Compositae (Asteraceae)	<i>Helianthus annuus</i> var. <i>macrocarpus</i>		Cultivated sun- flower	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to North America
Compositae (Asteraceae)	<i>Taraxacum officinale</i>		Common dandelion	PerF	Intro	Pres	Com	Fertig 23818 (PISP)	2008	New to PISP, previously on potential list. Native to Eurasia
Cruciferae (Brassicaceae)	<i>Brassica oleracea</i> var. <i>capitata</i>		Cabbage	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to Europe

Family	Species Name	Synonyms/ Taxonomic Notes	Common Name	Life Form	Range	Park Status	Pop. Size	Source	Year Doc.	Comments
Cruciferae (Brassicaceae)	<i>Lepidium lasiocarpum</i> var. <i>lasiocarpum</i>		Hairy-pod peppercorn	AnnF	Wide	Pres	Unc	Fertig 23822 (PISP)	2008	New to PISP
Cruciferae (Brassicaceae)	<i>Raphanus sativus</i>		Radish	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to Europe
Cucurbitaceae	<i>Citrullus lanatus</i>		Watermelon	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to Africa
Cucurbitaceae	<i>Cucumis melo</i>		Cantaloupe	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to tropical Africa & Asia
Cucurbitaceae	<i>Cucurbita maxima</i>		Winter squash	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to Central America
Cucurbitaceae	<i>Cucurbita moschata</i>		Butternut squash	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to Central America
Cucurbitaceae	<i>Cucurbita pepo</i>		Pumpkin, Zucchini	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to Central America
Cucurbitaceae	<i>Lagenaria siceraria</i>		Bottle gourd	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to Central America
Gramineae (Poaceae)	<i>Festuca octoflora</i>	<i>Vulpia octoflora</i>	Six-weeks fescue	AnnG	Wide	Pres	Rare	Fertig 23828 (PISP)	2008	New to PISP, previously on potential list.
Gramineae (Poaceae)	<i>Paspalum distichum</i>		Knotgrass	PerG	Wide	Pres	Unc	Fertig 24333 (PISP)	2008	New to PISP

Family	Species Name	Synonyms/ Taxonomic Notes	Common Name	Life Form	Range	Park Status	Pop. Size	Source	Year Doc.	Comments
Gramineae (Poaceae)	<i>Poa compressa</i>		Canada bluegrass	PerG	Intro	Pres	Rare	Fertig 23817 (PISP)	2008	New to PISP. Native to Eurasia
Gramineae (Poaceae)	<i>Sorghum bicolor</i>		Grain sorghum	PerG	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to Europe
Gramineae (Poaceae)	<i>Triticum aestivum</i>		Wheat	AnnG	Intro	Pres	Rare	Fertig 23824 (PISP)	2008	New to PISP, previ- ously on potential list. Native to Eurasia
Gramineae (Poaceae)	<i>Zea mays</i>		Maize, Corn	AnnG	Intro	Pres	Rare	Observed by W. Fertig	2008	Cultivated at PISP, native to Central America
Leguminosae (Fabaceae)	<i>Phaseolus acuti- folius</i>		Tepary bean	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to Central America
Liliaceae (Alliaceae)	<i>Allium cepa</i>		Cultivated onion	PerF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to Europe
Liliaceae (Asparagaceae)	<i>Asparagus offici- nalis</i>		Asparagus	PerF	Intro	Pres	Rare	Fertig 24324 (PISP)	2008	New to PISP. Native to Eurasia
Malvaceae	<i>Abelmoschus escu- lentus</i>		Okra	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to tropical Asia
Malvaceae	<i>Gossypium hirsutum</i>		Upland cotton	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to tropical America
Pedaliaceae (Marryniaceae)	<i>Proboscidea par- viflora</i>		Devil's claw	AnnF	Wide	Pres	Rare	Observed by W. Fertig	2008	Cultivated

Family	Species Name	Synonyms/ Taxonomic Notes	Common Name	Life Form	Range	Park Status	Pop. Size	Source	Year Doc.	Comments
Polemoniaceae	<i>Linanthus bigelovii</i>		Bigelow's linan- thus	AnnF	Wide	Pres	Rare	Fertig 23837 (PISP)	2008	New to PISP
Solanaceae	<i>Capsicum frutescens</i>		Bell pepper	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to Old World
Solanaceae	<i>Lycopersicon esculentum</i>		Tomato	AnnF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to South America
Solanaceae	<i>Physalis hederifolia</i> var. <i>fendleri</i>	<i>P. fendleri</i> , <i>P. hederifolia</i> var. <i>fendleri</i>	Fendler's ground- cherry	PerF	Wide	Pres	Unc	Fertig 24325 (PISP)	2008	New to PISP
Solanaceae	<i>Solanum tuberosum</i>		Potato	PerF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to South America
Umbelliferae (Apiaceae)	<i>Daucus carota</i>		Carrot	PerF	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP, native to Eurasia
Vitaceae	<i>Vitis</i> sp. (<i>V. vinifera</i> ?)		Grape	Shrub	Intro	Pres	Unc	Observed by W. Fertig	2008	Cultivated at PISP. Need to confirm species
Zannichelli- aceae	<i>Zannichellia palustris</i>		Horned pond- weed	PerF	Wide	Pres	Unc	Fertig 23835 (PISP)	2008	New to PISP

Codes: See Fertig and Alexander (2008, pp 17-19) for a full explanation of all categories and codes.

Life form: AnnF = Annual Forb (non-woody broad-leaved plants that complete their life cycle in one year), AnnG = Annual Graminoid (grass-like plants that complete their life cycle in one year), PerF = Perennial Forb (non-woody broad-leaved plants that live for multiple years), PerG = Perennial Graminoid (grass-like plants that live for multiple years), Shrub (woody perennials with one to many trunks and usually less than 3-5 m tall).

Range: Intro = Introduced (non-native), RegEn = Regional Endemic (taxa with a global range of 16,500-250,000 square km (an area about the size of the state of Wyoming), Wide = Widespread (taxa have global ranges exceeding 250,000 square km and occur over at least 10% of the state).

Park Status: Pres = Present

Pop. Size (population size): Com = Common, Unc = Uncommon, Rare = Rare.

Table 3. Changes in the Status or Nomenclature of Vascular Plant Taxa Previously Confirmed or Reported for Pipe Spring National Monument Based on 2008 Survey. Updated information differing from Fertig and Alexander (2008) is indicated in **bold**. See page 10 for explanation of codes.

Family	Species Name	Synonyms/ Taxonomic Notes	Common Name	Life Form	Range	Park Status	Pop. Size	Source	Year Doc.	Comments
Boraginaceae	<i>Cryptantha flava</i>	<i>Oreocarya flava</i>	Plateau yellow cryptanth	Perf	Wide	Rep	?	Alexander (1998a)	NA	PISP re- port may be based on <i>C. con- fertiflora</i>
Boraginaceae	<i>Cryptantha gracilis</i>		Slender cryptanth	AnnF	Wide	Pres	Unc	Fertig 23830 (PISP)	1937	Previously cited as His- torical
Chenopodi- aceae	<i>Krascheninnikovia lanata</i> var. <i>sub- spinos</i>	<i>Eurotia lanata</i> , <i>Cercoides lanata</i> var. <i>sub- spinos</i> a. Vars not recognized in Flora of North America (2003)	Shrubby winter- fat	Shrub	Wide	Pres	Unc	Peebles 13079 (ARIZ)	1936	Previously cited as His- torical. Ob- served vege- tatively by W. Fertig, 2008.
Chenopodi- aceae	<i>Suaeda nigra</i> var. <i>nigra</i>	<i>Suaeda torrey- ana</i> var. <i>torre- yana</i> , <i>S. mo- quini</i>	Torrey's seep- weed	AnnF	Wide	Pres	Unc	Alexander 1252 (PISP)	2001	Name re- vised in Welsh et al. (2008)
Compositae (Asteraceae)	<i>Artemisia bigelovii</i>		Bigelow's sage- brush	Shrub	Wide	Pres	Unc	Fertig 24327 (PISP)	1977	Voucher collected in 2008
Compositae (Asteraceae)	<i>Chrysothamnus nauseosus</i> var. <i>oreophilus</i>	<i>Chrysotham- nus nauseosus</i> var. <i>consimilis</i> , <i>Eriocameria nau- seosa</i> var. <i>con- similis</i> , <i>E. nau- seosa</i> var. <i>oreo- phila</i>	Greenish rabbit- brush	Shrub	Wide	Pres	Com	Alexander 1219 (PISP)	1998	Name re- vised in Welsh et al. (2008)

Family	Species Name	Synonyms/ Taxonomic Notes	Common Name	Life Form	Range	Park Status	Pop. Size	Source	Year Doc.	Comments
Compositae (Asteraceae)	<i>Chrysanthemum nauseosus</i> var. <i>hololeucus</i>	<i>Chrysanthamus nauseosus</i> var. <i>gna- phalodes</i> , <i>Eri- cameria nau- seosa</i> var. <i>hololeuca</i>	Graystem rabbit- brush	Shrub	Wide	Pres	Unc	Fertig 23665 (PISP)	2007	Name re- vised in Welsh et al. (2008)
Compositae (Asteraceae)	<i>Conyza canadensis</i> var. <i>glabrata</i>	<i>Erigeron cana- densis</i> . Vars not recognized in Flora of North America (2006)	Canadian horse- weed	AnnF	Wide	Pres	Unc	Fertig 24334 (PISP)	1935	Previously Reported (without voucher).
Compositae (Asteraceae)	<i>Senecio flac- cidus</i> var. <i>flac- cidus</i>	<i>Senecio doug- lassii</i> var. <i>longilobus</i> , <i>S. longilobus</i> , <i>S. flaccidus</i> var. <i>douglasii</i>	Douglas' ground- sel	PerF	Wide	Pres	Unc	Whitehead s.n. (PISP)	1935	Name re- vised in Welsh et al. (2008)
Cruciferae (Brassicaceae)	<i>Arabis perennans</i> var. <i>perennans</i>	<i>Boechera peren- nans</i>	Perennial rock- cress	PerF	Wide	Pres	Unc	Fertig 23832 (PISP)	1998	Previously Reported (without voucher)
Cruciferae (Brassicaceae)	<i>Streptanthella longirostris</i>		Long-beak fiddle- mustard	AnnF	Wide	Pres	Unc	Fertig 23823 (PISP)	1937	Previously cited as His- torical
Gramineae (Poaceae)	<i>Echinochloa crus- galli</i>	<i>E. microstachya</i> , <i>E. microstachya</i> var. <i>muricata</i>	Barryard-grass	AnnG	Intro	Pres	Unc	Fertig 24323 (PISP)	1998	Previously Reported (without voucher). Native to Eurasia
Gramineae (Poaceae)	<i>Elymus elymoides</i>	<i>Sitanion hystrix</i> , <i>E. elymoides</i> var. <i>elymoides</i>	Squirreltail	PerG	Wide	Pres	Com	Fertig 23821 (PISP)	1977	Previously Reported (without voucher)

Family	Species Name	Synonyms/ Taxonomic Notes	Common Name	Life Form	Range	Park Status	Pop. Size	Source	Year Doc.	Comments
Gramineae (Poaceae)	<i>Eragrostis cilianensis</i>		Stinkgrass	AnnG	Intro	Pres	Unc	Fertig 24318 (PISP)	1977	Previously Reported (without voucher). Native to Eurasia
Gramineae (Poaceae)	<i>Poa pratensis</i>	<i>Poa agassizensis</i>	Kentucky blue- grass	PerG	Intro	Pres	Unc	King (1977)	1977	Previously Reported. Observed vegetatively by W. Fertig in 2008.
Gramineae (Poaceae)	<i>Polypogon monspeliensis</i>	<i>Agrostis monspeliensis</i> , <i>P. viridis</i>	Water polypogon	PerG	Intro	Pres	Unc	Fertig 24321 (PISP)	1998	Previously Reported (without voucher). Native to Eurasia and Africa
Gramineae (Poaceae)	<i>Sporobolus airoides</i> var. <i>airoides</i>	<i>S. airoides</i>	Alkali sacaton	PerG	Wide	Pres	Unc	Fertig 24335 (PISP)	1977	Previously Reported (without voucher).
Gramineae (Poaceae)	<i>Stipa hymenoides</i>	<i>Oryzopsis hymenoides</i> , <i>Achnatherum hymenoides</i>	Indian ricegrass	PerG	Wide	Pres	Unc	Fertig 23820 (PISP)	1977	Voucher collected in 2008
Iridaceae	<i>Sisyrinchium dimissum</i>		Blue-eyed grass	PerF	Wide	Pres	Unc	Fertig 24329 (PISP)	1998	Previously Reported (without voucher)

Family	Species Name	Synonyms/ Taxonomic Notes	Common Name	Life Form	Range	Park Status	Pop. Size	Source	Year Doc.	Comments
Leguminosae (Fabaceae)	<i>Melilotus alba</i>	<i>M. albus</i> , included in <i>M. officinalis</i> by some authors	White sweet-clover	AnnF	Intro	Pres	Unc	Fertig 24331 (PISP)	1977	Previously Reported (without voucher). Native to Europe
Malvaceae	<i>Sphaeralcea parvifolia</i>		Small-leaf globe-mallow	PerF	Wide	Pres	Unc	Whitehead s.n. (PISP)	1936	Previously cited as Histerical. Observed (but not collected) by Fertig in 2008.
Polemoniaceae	<i>Ipomopsis polycladon</i>	<i>Gilia polycladon</i>	Spreading gilia	AnnF	Wide	Pres	Unc	Fertig 23831 (PISP)	1937	Previously cited as Histerical
Ranunculaceae	<i>Delphinium scaposum</i> var. <i>scaposum</i>	<i>Delphinium anderssonii</i> var. <i>scaposum</i>	Pale larkspur	PerF	Wide	Hist	?	Peebles 13077 (ARLZ)	1936	Name revised in Welsh et al. (2008)
Solanaceae	<i>Solanum saracoides</i>	<i>S. villosum</i> , <i>S. physalifolium</i> var. <i>nitidibaccatum</i>	Ground-cherry nightshade	AnnF	Intro	Pres	Rare	Fertig 24320 (PISP)	1998	Previously Reported (without voucher). Native to South America
Tamaricaceae	<i>Tamarix chinensis</i>	<i>T. pentandra</i> , <i>T. ramosissima</i>	Five-stamen tamarisk	Shrub	Intro	Pres	Rare	Fertig 24322 (PISP)	1977	Previously Reported (without voucher). Native to Eurasia

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